

101
100
B⁶ 114. The method of Claim 110 wherein the step (e) comprises displaying said near-field, intermediate field and far-field regions in a common imaging mode.--

C. Please cancel claims 62-71. ✓

REMARKS

In the Office Action, the Examiner rejected claims 1-7, 32-33, 48-51 and 83-86 pursuant to 35 U.S.C. § 103(a) as being unpatentable over (a) Seward et al. (U.S. Patent No. 5,699,805) and Panescu et al. (U.S. Patent No. 5,740,808) or (b) Umemura et al. (U.S. Patent No. 5,435,311). Claims 60 and 61 were also rejected in the Examiner's discussion, but not rejected on the Office Action cover sheet. Claims 8-31, 34-47, and 52-61 were objected to on the Office Action cover sheet and not addressed in the Examiner's discussion. Finally, the Examiner's discussion indicated that claims 72-82 and 87-99 are allowable over the prior art, but the Office Action cover sheet listed these claims as subject to a restriction requirement. Since these claims were not restricted out in the earlier restriction requirement, Applicant has treated these claims as allowable pursuant to the Examiner's discussion.

Prior Art Rejections:

Independent Claims 1 and 83:

Applicants respectfully request reconsideration of the rejection of independent Claims 1 and 83 as amended. For the rejection based on Seward et al. and Panescu et al., the Examiner noted that Seward et al. disclose a "three-dimensional catheter-based system [that] would include harmonic echocardiography, without further specifying sans contrast agent presence." The Examiner cited Panescu et al. as disclosing 3D ultrasound catheter-based imaging where second harmonics sans contrast agent may form such echocardiography.

Seward et al. generally disclose a volumetric, 3-dimensional imaging underfluid catheter system (col. 1, lines 51-52). The catheter is designed to allow rotation of a transducer array (col. 6, lines 33-53 and Figures 5-7). As part of the discussion of a control system, a variety of known functions are listed as part of a conventional ultrasound unit (col. 5, lines 39-54). One of the functions listed is harmonic echocardiography. Seward et al. do not disclose any further information regarding harmonics. As noted by the Examiner, Seward et al. do not specify sans contrast agent.

Panescu et al. disclose a system for guiding and locating a catheter within the interior of a body (col. 1, lines 46-59). Contrast Echocardiography is disclosed as one type of visualization during cardiac mapping (col. 16, line 42 and col. 17, line 34-col. 18, line 4). After injection of contrast agents, a three-dimensional image for display is created (col. 18, lines 51-65). Various tissues are visually characterized by the user from the images (col. 19, lines 1-21). Panescu et al. also disclose that "the system 170 may characterize tissue morphology based upon echocardiography to locate potential ablation sites in other ways" (col. 19, lines 63-65). One example includes ultrasonic frequency domain analyses, such as intensity of the second harmonics (col. 19, line 65-col. 20, line 3). Frequency domain analysis may be used without the injection of contrast media (col. 20, lines 3-5). However, Panescu et al. do not disclose how to perform the frequency domain analysis. For example, the information may be transformed into the frequency domain. The resulting frequency domain information (e.g. spectrum) may then be analyzed.

Claims 1 and 83 as amended require filtering from echo information a plurality of information signals associated with a second frequency band comprising at least a harmonic band. Neither Seward et al. or Panescu et al. disclose filtering to obtain information signals at a harmonic band. Panescu et al. disclose some form of frequency domain analysis.

For the rejection based on Unemura et al., the Examiner noted a teaching "of generating second harmonics for 3D imaging using the non-linear tissue harmonic effect of higher power ultrasonic wave transmissions." Unemura et al. disclose a system for ultrasound therapy. Monitoring ultrasounds are used to display images (col. 4, lines 1-20). While transmitting the monitoring ultrasounds, three-dimensional images may be formed by rotating the transmitters/receivers (col. 4, lines 21-29). In order to provide therapy, the

doctor fixes the applicator (col. 4, lines 30-33). Focused ultrasounds are transmitted for the therapy (col. 4, lines 33-40). Harmonic information from the focused ultrasound passes through the same path and is subjected to the same processing as the ultrasonic pulse echo signal (monitoring ultrasounds)(col. 4, lines 40-45). As described in another embodiment, the focused ultrasounds are converted into harmonics in the same frequency band as the imaging ultrasound (col. 8, lines 21-32). Since the harmonics of the focused ultrasound are in the same band as the fundamental of the monitoring ultrasounds, the same processing is used for both.

Claims 1 and 83 as amended require filtering from echo information a plurality of information signals associated with a second frequency band comprising at least a harmonic band. Unemura et al. does not disclose filtering to obtain information signals at a harmonic band. Unemura et al. disclose using the same processing. Furthermore, the imaging involving harmonics disclosed by Unemura et al. is not used for three-dimensional imaging. The transmitter/receiver is rotated for three-dimensional imaging. For therapy, the applicator is fixed in one position.

Dependent Claims 2-7, 32-33, 48-51, 60-61 and 84-86

The above listed dependent claims 2-7, 32-33, 48-51, 60-61 and 84-86 depend from the various independent claims discussed above. Therefore, applicants believe these dependent claims are allowable for the reasons stated above for the corresponding independent claims. Furthermore, limitations of these dependent claims further distinguish the claims from the cited prior art. For example and respectfully traversing the Examiner's rejection, the Examiner does not cite a disclosure of the use of two transmit focal regions for each ultrasound transmit line direction, as claimed in claim 32. As another example, the Examiner does not cite a disclosure of displaying a sequence of images as a function of time that are responsive to the three-dimensional reconstruction, as claimed in claim 51. For purposes of brevity, other distinctions are not addressed herein since Applicants believe the independent claims as amended are allowable.

Added Claims:

Added claims 100-104 correspond to claims that were objected to by the Examiner rewritten in independent form incorporating the limitations of the base claim and any intervening claims. Claim 100 corresponds to claim 9, and claims 101-104 correspond to claims 23-26.

Claim 105 corresponds to claim 32, discussed and distinguished above as a dependent claim.

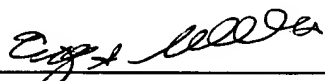
Claims 106-114 were added to explore further patentable subject matter contained in the disclosure of the above captioned application. Generally, claim 106 corresponds to dependent claim 23 without the step (e) limitation. Therefore, Applicants believe these claims are appropriately added to this application in light of the earlier restriction requirement.

Conclusion:

Applicants respectfully submit that all of the pending claims are in condition for allowance and seeks early allowance thereof. If for any reason, the Examiner is unable to allow the application but believes that an interview would be helpful to resolve any issues, he is respectfully requested to call the undersigned at (312) 321-4726.

Respectfully submitted,

Dated: December 9, 1998



Craig A. Summerfield
Registration No. 37,947

Attorney for Applications

BRINKS HOFER GILSON & LIONE
Post Office Box 10395
Chicago, Illinois 60610
Telephone: (312) 321-4200
Facsimile: (312) 321-4299